Claims

1. An expression vector comprising a nucleic acid encoding a fusion polypeptide, said fusion polypeptide comprising

a first amino acid sequence which is selected from: a carbohydrate binding domain of a collectin; a carbohydrate binding domain of a galectin; a carbohydrate binding domain of a C-type lectin; or an amino acid sequence which can bind to a carbohydrate on a glycoprotein, said carbohydrate being chosen from the group: D-mannose, D-glucose, D-fucose, L-fucose, N-acetyl-beta-D-glucosamine, N-acetyl-beta-D-glucosamine, a sialic acid;

and

a second amino acid sequence comprising a ligand for a cell surface polypeptide, said ligand being chosen from the group: a ligand for a cytokine receptor, a ligand for CD40, a ligand for an adhesion molecule, a ligand for a defensin receptor, a ligand for a heat shock protein receptor, a ligand for a counterreceptor for a T cell costimulatory molecule.

2. The expression vector of claim 1, wherein said first amino acid sequence is N-terminal to said second amino acid sequence.

3. The expression vector of claim 1, wherein said first amino acid sequence is C-terminal to said second amino acid sequence.

4. The expression vector of claim 1, wherein said first amino acid sequence can bind to a sialic acid on a glycoprotein, said sialic acid comprising at least one of the following carbohydrate structures: N-acetylneuraminic acid, alpha-NeuNAc-[2->6]-Gal, alpha-NeuNAc-[2->6]-GalNAc, alpha-NeuNAc-[2->3]-Gal.

5. The expression vector of claim 1, wherein said first amino acid sequence comprises a carbohydrate-binding domain of a naturally occuring lectin.

6. The expression vector of claim 1, wherein said first amino acid sequence comprises at least about 10 contiguous amino acids of a hemagglutinin.

7. The expression vector of claim 6, wherein said hemagglutinin is an influenza virus hemagglutinin.

8. The expression vector of claim 7, wherein said contiguous amino acids of an influenza hemagglutinin are contiguous amino acids of an influenza hemagglutinin HA1 domain.

9. The expression vector of claim 7, wherein said influenza virus is an influenza A virus.

10. The expression vector of claim 9, wherein said influenza virus is of a subtype that infects humans.

11. The expression vector of claim 9, wherein said influenza virus is of an H1 subtype.

12. The expression vector of claim 11, wherein said influenza virus is from the strain A/PR/8/34.

13. The expression vector of claim 10, wherein said influenza virus is of an H2 or H3 subtype.

14. The expression vector of claim 7, wherein said influenza virus is of a subtype that does not infect humans.

15. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mammalian cell surface polypeptide.

16. The expression vector of claim 15, wherein said ligand for a cell surface polypeptide is a ligand for a mouse cell surface polypeptide.

17. The expression vector of claim 15, wherein said ligand for a cell surface polypeptide is a ligand for a human cell surface polypeptide.

18. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a leukocyte.

19. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of an antigen presenting cell.

20. The expression vector of claim 19, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a professional antigen presenting cell.

21. The expression vector of claim 18, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a dendritic cell.

22. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mouse GM-CSF receptor.

23. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse GM-CSF.

24. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises a mouse GM-CSF.

25. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a human GM-CSF receptor.

26. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human GM-CSF.

27. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises a human GM-CSF.

28. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for an interleukin.

29. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse interleukin.

30. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human interleukin.

31. The expression vector of claim 28, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

32. The expression vector of claim 28, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of an interleukin.

33. The expression vector of claim 32, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

34. The expression vector of claim 28, wherein said ligand for a cell surface polypeptide comprises an interleukin.

35. The expression vector of claim 34, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

36. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a chemokine.

37. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse chemokine.

38. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human chemokine.

39. The expression vector of claim 36, wherein said chemokine is a C-C cytokine.

40. The expression vector of claim 36, wherein said chemokine is a C-X-C cytokine.

41. The expression vector of claim 36, wherein said cell surface polypeptide is chosen from the group: CXCR-1, CXCR-2, CXCR-3, CXCR-4, CCR-1, CCR-2, CCR-3, CCR-4, CCR-5, CCR-6, CCR-7, CCR-8.

42. The expression vector of claim 36, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

43. The expression vector of claim 36, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of a chemokine.

44. The expression vector of claim 43, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

45. The expression vector of claim 36, wherein said ligand for a cell surface polypeptide comprises a chemokine.

46. The expression vector of claim 45, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2,

MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

47. The expression vector of claim 1,wherein said ligand for a cell surface polypeptide is a ligand for a receptor for an interferon.

48. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse interferon.

49. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human interferon.

50. The expression vector of claim 47, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

51. The expression vector of claim 47, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of an interferon.

52. The expression vector of claim 51, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

53. The expression vector of claim 47, wherein said ligand for a cell surface polypeptide comprises an interferon.

54. The expression vector of claim 53, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

55. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mouse TNF-alpha receptor.

56. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse TNF-alpha.

57. The expression vector of any claim 1, wherein said ligand for a cell surface polypeptide comprises a mouse TNF-alpha.

58. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a human TNF-alpha receptor.

59. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human TNF-alpha.

60. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises a human TNF-alpha.

61. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mouse flt-3 receptor.

62. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse flt-3.

63. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises a mouse flt-3.

64. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a human flt-3 receptor.

65. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human flt-3.

66. The expression vector of claim 1, wherein said ligand for a cell surface polypeptide comprises a human flt-3.

67. The expression vector of claim 1, wherein said encoded fusion polypeptide further comprises a linker interposed between said first and second amino acid sequences.

68. The expression vector of claim 67, wherein said linker has the formula $(Gly_xSer)_n$, wherein n is an integer between 1 and 15, and x is an integer between 1 and 10.

69. The expression vector of claim 1, wherein said encoded fusion polypeptide further comprises a secretory signal sequence.

70. The expression vector of claim 1, which is a eukaryotic expression vector.

71. The expression vector of claim 70, which is a yeast expression vector.

72. The expression vector of claim 70, which is a mammalian expression vector.

73. The expression vector of claim 1, which comprises an inducible promoter.

74. A host cell comprising a nucleic acid molecule encoding a fusion polypeptide, said fusion polypeptide comprising

a first amino acid sequence which is selected from: a carbohydrate binding domain of a collectin; a carbohydrate binding domain of a galectin; a carbohydrate binding domain of a C-type lectin; or an amino acid sequence which can bind to a carbohydrate on a glycoprotein, said carbohydrate being chosen from the group: D-mannose, D-glucose, D-fucose, L-fucose, N-acetyl-beta-D-glucosamine, N-acetyl-beta-D-glucosamine, a sialic acid;

and

a second amino acid sequence comprising a ligand for a cell surface polypeptide, said ligand being chosen from the group: a ligand for a cytokine receptor, a ligand for CD40, a ligand for an adhesion molecule, a ligand for a defensin receptor, a ligand for a heat shock protein receptor, a ligand for a T cell costimulatory molecule, a ligand for a counterreceptor for a T cell costimulatory molecule.

75. The host cell of claim 74, wherein said first amino acid sequence is N-terminal to said second amino acid sequence.

76. The host cell of claim 74, wherein said first amino acid sequence is C-terminal to said second amino acid sequence.

77. The host cell of claim 74, wherein said first amino acid sequence can bind to a sialic acid on a glycoprotein, said sialic acid comprising at least one of the following carbohydrate structures: N-acetylneuraminic acid, alpha-NeuNAc-[2->6]-Gal, alpha-NeuNAc-[2->6]-GalNAc, alpha-NeuNAc-[2->3]-Gal.

78. The host cell of claim 74, wherein said first amino acid sequence comprises a carbohydrate-binding domain of a naturally occuring lectin.

79. The host cell of claim 74, wherein said first amino acid sequence comprises at least about 10 contiguous amino acids of a hemagglutinin.

80. The host cell of claim 79, wherein said hemagglutinin is an influenza virus hemagglutinin.

81. The host cell of claim 80, wherein said contiguous amino acids of an influenza hemagglutinin are contiguous amino acids of an influenza hemagglutinin HA1 domain.

82. The host cell of claim 80, wherein said influenza virus is an influenza A virus.

83. The host cell of claim 80, wherein said influenza virus is of a subtype that infects humans.

84. The host cell of claim 82, wherein said influenza virus is of an H1 subtype.

85. The host cell of claim 83, wherein said influenza virus is from the strain A/PR/8/34.

86. The host cell of claim 82, wherein said influenza virus is of an H2 or H3 subtype.

87. The host cell of claim 80, wherein said influenza virus is of a subtype that does not infect humans.

88. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a mammalian cell surface polypeptide.

89. The host cell of claim 88, wherein said ligand for a cell surface polypeptide is a ligand for a mouse cell surface polypeptide.

90. The host cell of claim 88, wherein said ligand for a cell surface polypeptide is a ligand for a human cell surface polypeptide.

91. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a leukocyte.

92. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of an antigen presenting cell.

93. The host cell of claim 19, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a professional antigen presenting cell.

94. The host cell of claim 91, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a dendritic cell.

95. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a mouse GM-CSF receptor.

96. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse GM-CSF.

97. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises a mouse GM-CSF.

98. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a human GM-CSF receptor.

99. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human GM-CSF.

100. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises a human GM-CSF.

101. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for an interleukin.

102. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse interleukin.

103. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human interleukin.

104. The host cell of claim 101, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

105. The host cell of claim 101, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of an interleukin.

106. The host cell of claim 105, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

107. The host cell of claim 101, wherein said ligand for a cell surface polypeptide comprises an interleukin.

108. The host cell of claim 107, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

109. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a chemokine.

110. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse chemokine.

111. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human chemokine.

112. The host cell of claim 109, wherein said chemokine is a C-C cytokine.

113. The host cell of claim 109, wherein said chemokine is a C-X-C cytokine.

114. The host cell of claim 109, wherein said cell surface polypeptide is chosen from the group: CXCR-1, CXCR-2, CXCR-3, CXCR-4, CCR-1, CCR-2, CCR-3, CCR-4, CCR-5, CCR-6, CCR-7, CCR-8.

115. The host cell of claim 109, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

116. The host cell of claim 109, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of a chemokine.

117. The host cell of claim 116, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

118. The host cell of claim 109, wherein said ligand for a cell surface polypeptide comprises a chemokine.

119. The host cell of claim 118, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

120. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for an interferon.

121. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse interferon.

122. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human interferon.

123. The host cell of claim 120, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

124. The host cell of claim 120, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of an interferon.

125. The host cell of claim 124, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

126. The host cell of claim 120, wherein said ligand for a cell surface polypeptide comprises an interferon.

127. The host cell of claim 126, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

128. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a mouse TNF-alpha receptor.

129. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse TNF-alpha.

130. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises a mouse TNF-alpha.

131. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a human TNF-alpha receptor.

132. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human TNF-alpha.

133. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises a human TNF-alpha.

134. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a mouse flt-3 receptor.

135. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse flt-3.

136. The host cell of any claim 74, wherein said ligand for a cell surface polypeptide comprises a mouse flt-3.

137. The host cell of claim 74, wherein said ligand for a cell surface polypeptide is a ligand for a human flt-3 receptor.

138. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human flt-3.

139. The host cell of claim 74, wherein said ligand for a cell surface polypeptide comprises a human flt-3.

140. The host cell of claim 74, wherein said encoded fusion polypeptide further comprises a linker interposed between said first and second amino acid sequences.

141. The host cell of claim 140, wherein said linker has the formula $(Gly_xSer)_n$, wherein n is an integer between 1 and 15, and x is an integer between 1 and 10.

142. The host cell of claim 74, wherein said encoded fusion polypeptide further comprises a secretory signal sequence.

143. The host cell of claim 74, which is a prokaryotic cell.

144. The host cell of claim 74, which is a eukaryotic cell.

145. The host cell of claim 144, which is a yeast cell.

146. The host cell of claim 144, which is a mammalian cell.

147. The host cell of claim 144, which is an insect cell.